DETERMINATION OF ECONOMIC EFFICIENCY IN TERMS OF RISK AND UNCERTAINTY

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Abstract:
The profitability of any economic activity, in general, and in particular of the investment, depends mainly by several factors which are subject to risk and uncertainty. The economists make a distinction between risk and uncertainty, in the sense that risk is associated to an activity, an investment project is the result of uncertainty which characterizes the objective or achievement of an activity.

Key words: risk, uncertainty, return, games theory, investment, probabilities, dispersion

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In the domain of economics risk is defined as the chance or possibility that an unfavorable event should occur based on the decision variables, an event which may generate losses. Strictly connected to the investment decision, risk is conceived as the probability of losing a gain.

It is well known that any economic activity is doubled by a certain degree of risk which can be more or less forecast. While uncertainty is defined as "the manifestation of doubt about the occurrence of a certain future event, risk represents a concept with an economic, social, political, and natural dimension which reflects the possibility that a certain future event / activity may lead to losses generated by insufficient or inexistent information in the moment when the decision is made or by the use of a "sound" reasoning that will prove to be bad and wrong"[1].

Uncertainty can be defined as the situation when results cannot be entirely identified or when there is a certain degree of probability that they may occur. "A person is subject to risk whenever there is a chance that an unfavourable (favourable) event may decrease (increase) the value of an asset he / she owns."[2]

The elements that risk is based on are probability, the decisional proces and uncertainty.

The efficiency of any economic activity in general and of the investment activity in particular depends mainly on factors influenced by risk and uncertainty such as:

- the value of the expected profit – in a market economy the success or failure of selling a product will depend on its capacity to satisfy the consumer's needs;

- the size of operating costs (costs of buying raw materials, power, paying salaries etc.). These costs have a variable character in time based on the raw materials price variation.

- the equipment life span which can also be quite uncertain, based on physical wear and obsolence triggered by the dynamics of the technological progress;

- the updating rate which covers the different uncertainty situations affecting the expected yield of an investment.

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[1] Zaman, Gh., Geamănu, M., *Economic efficiency,* FRM Publishing House, Bucharest, 2006, p. 143
[2] Munteanu C., Horobeţ A., *Transnational finance,* All Beck Publishing House, Bucharest, 2003, p. 361

Risk is an economic variable that can be controlled by estimating it based on the dimension and quality of the factors determining it. In risk conditions one can associate a probability of occurence to any event. Probability has two acceptions: an objective and a subjective one. The objective probability reflects the frequency with which a certain event has occured along an observation cluster and the subjective probability refers to an individual's perception related to the possibility that a certain event may occur. The determination of the cause of unfavourable consequences generated by a certain risk can be made by using the theory of probabilities. Different from the deterministic conception based on the assumption that activities develop in entirely safe conditions, the probabilistic theory assumes that the possibility that certain risks may occur, with unfavourable consequences, is closer to reality.

In the context of the market economy any Romanian or foreign investor's activity is subject to certain risks. Investors prefer projects with a higher forecast efficiency to those with a lower efficiency and in case of equally efficient projects they will prefer the one with a lower degree of risk. This attitude bears the name of risk aversion.[3].

Risk is a fairly complex category which can take many forms. The specialized literature defines many different types of risks (economic risk, financial risk, currency risk, investment risk, production risk, ecological risk, political risk, country risk). It is important to understand the two concepts of risk and uncertainty correctly. Economists make a clear distinction between risk and uncertainty in the sense that the risk associated to an activity, to an investment project is the consequence of the uncertainty characterizing the achievement of the respective activity or objective.

From the financial specialists' point of view a risky situation is defined as that situation for which one can determine a priori the probability distribution law for its different results. The uncertain situation is defined as that situation for which it is not possible to determine the probability distribution law a priori.

The main factor of risk is the unequal and rapid evolution of the technological progress which influences the volume and structure of the demand, the costs as well as the degree to which products and services are updated.

The forecast character of the data taken into consideration when making decisions, especially in the domain of investments, determine their degree of risk. Investments are risky because their result depends on an uncertain future. In economic terms, risk represents the chance or possibility that an unfavorable event should occur based on the decision variables, an event which may generate losses. Strictly connected to the investment decision, risk is conceived as the probability of losing a gain.

The concept of *risk* refers only to those situations which can be quantified while the term *uncertainty* is associated to situations which cannot be quantified. Uncertainty is generated by insufficient or even inexistent reliable information on the consequences of a future action. It refers to the doubt created by the occurence of a future event and it is defined as the lack of knowledge about what will happen, while risk is based on a past experience, on vast statistical data, so that a forecast can be made about the probability that a certain event might happen in the future. Risk refers to something that can be forecast using a probability law and therefore it can be quantified as the probability that a certain event might take place, while the cause of uncertainty is hardly measurable.

The traditional risk measurement is made by using the efficiency probability distribution law. The most relevant points for the analysis are:
- the average loss;
- the loss probability;
- the bankruptcy probability;

[3] Baileşteanu Gh., *Diagnosis, risk and efficiency in business*, Mirton Publishing House, Timişoara, 1998

- the variation which has come to be regarded more and more as a "natural" measure against risk.

Variance measures the dispersion of a cluster around its central tendecy. It is represented by the mathematical expectancy of the spacings square values between each value and the mathematical expectancy of the cluster. The typical spacing represents the square root of a variant.

Other measures that can be taken against risk are **the Baumol coefficient** and **the Mao coefficient.**

The Baumol coefficient was at first used for evaluating the risk of investments in shares. For Wiliam Baumol, it is not the absolute value of the deviation that should be feared but the fact that an increased deviation might mean a weak or negative efficiency. The most interesting issue for the decision-maker is the negative efficiency level. Baumol's model consists in "defining the risk aversion level" and then in measuring the risk of the project staring from the average spacing of the project's efficiency and the typical spacing of this efficiency, influenced by a coefficient corresponding to the risk aversion level"[4].

$\alpha = x - \alpha\sigma$, where:

x = the mean of the possible yield;

σ = the type of deviation for these yields;

α = the risk aversion coefficient.

The American economist JCT Mao suggests a completely different method of measuring risk than the one used by William Baumol. His approach is based on the failure risk of a project which is defined as an expected and measured value starting fom the semi-variance The semi-variance of a project is defined as the expected value of the negative deviations square values of a project's yield compared to a previously extablished level. This measurement offers the advantage of focusing on a project's failure defined as insufficient yield.

This methodology has not enjoyed a significant practical applicability. In practice one can distinguish four main methodological classes which allow *uncertainty related to the future* to be take into account.

1. The „future-phobic" criterion method consists in assessing the quality of an investment project by using time as the main criterion of evaluating risk. The future-phobic criterion method considers near future as being less risky than farther future which is, by definition, riskier. The criterion used is the time (T) necessary to recuperate the invested capital. The shorter this time is the less risky the investment is considered and the other way round.

2. The method of events probability distribution consists in building hypotheses about the nature of the probabilities distribution law. The most frequently used is *the normal distribution law* which is preferred rather due to its simplicity than to its degree of realism.

3. The method of considering a risk premium, by multiplying the updating rate with a premium. The increase of the updating rate will mechanically lead to the diminishing of the total updated net value. This method allows the retention of only those projects for which the flow value is directly connected to the level of the retained risk.

4. The *reliable equivalents method* is based on attaching a coefficient of uncertainity to the treasury flows of a project, the assessment of the investment being made by updating the corrected treasury flows. This method is interesting due to its capacity of taking into account the risk increase in time, by means of *differentiated*

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[4] Zaman, Gh., Geamănu, M., *Economic efficiency,* FRM Publishing House, Bucharest, 2006, p. 140

coefficients. The assessment of investment projects while taking risk into consideration is made by using indicators based on the theory of probabilities[5].

Any economic activity is performed under risk conditions which affect economic efficiency both in terms of effects and efforts. In terms of effects and efforts, efficiency can be affected by risk in at least the following ways:

a) variation of effects, while efforts remain constant;

b) variation of efforts while effects remain unchanged;

c) both efforts and effects modify;

d) variation of the duration of an activity.

One of the major problems that economic science is confronted with is the measurement of risk as a factor influencing economic efficiency. In order to better understand the ways of quantifying risk we will give an example related to economic efficiency.

In an initial phase, when we have more variants of investment projects, each of them will be attributed a certain degree of risk which will allow the classification of the respective projects by risk classes and sub-classes.

In general, a single probability distribution is established which is considered specific for the yearly net profit, for the whole economic life span of a business entity. After the typical probability distribution has been established one can move on to determining the average total updated net value ($\overline{VNAT}$) according to the equation:

- $\overline{VNAT} = \mathrm{E\,(VNAT)} = \sum_{a=1}^{n} \frac{\overline{FL}}{(1+\alpha)^a}$, where E (VNAT) represents the

estimated updated net value.

Then **dispersion** is calculated: σ^2 (VNAT) and **standard deviation** σ (VNAT), using the following equations:

- $\sigma^2 \,(\mathrm{VNAT}) = \sum_{a=0}^{n} \frac{\sigma^2 \times a}{(1+\alpha)^{2a}}$

- $\sigma = \sqrt{\sigma^2 (VNAT)} = \sqrt{\sum p_i (FL_i - \overline{FL})^2}$, where:

FL_i = estimated yearly value of liquid assets in year a;

$\overline{FL}$ = average value of liquid assets;

The two indicators measure risk directly, that is its absolute value.

In order to determin the risk of the investment project the *coefficient of variation (CV)* is calculated, expressed as the ratio between the standard deviation σ (VNAT) and the estimated updated net value E(VNAT), that is:

- $\mathrm{CV} = \dfrac{\sigma(VNAT)}{E(VNAT)}$

The coefficient of variation (CV) expresses the relative deviation of a project's updated net value, offering the possibility to compare it with other projects in terms of risk.

Risk determination is highly influenced by the degree of subjectivity of the specialist who establishes the probability distribution. An important aspect influencing the subjectivity of the probability distribution is represented by the economic situation.

The technique dealing with uncertainty situations by means of models that indicate a decision or strategy according to the decision maker's preferences is known as the **game theory.**

After the identification of the possible situations based on events which are known but whose accomplishment is uncertain, the methods based on the game theory

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[5] Vladimirescu I., *Theory of probabilities*, Universitaria Publishing House, Craiova, 2000

allow the finding out of the situation which corresponds to the decision maker's preferences in the highest degree. Although there are numerous methods based on the game theory which suggest criteria for choosing from among alternative situations the most frequently used are *the Laplace criterion, the Wald criterion, the Savage criterion* and *the Hurwitz criterion*.

The Laplace Criterion is based on the calculation of the arithmetic mean of expected incomes for each of the situations taken into consideration and it recommends the retention of the strategy whose mean is the highest. When no information is available on the probabilities of nature's state (forecast) this criterion can be used.

The Wald Criterion, also known as the **Maximin** criterion or the pessimistic method is based on the retention of the sollution which maximizes the minimum gain of each decision. The Wald criterion is by definition a criterion of prudence. It is based on the implicit hypothesis of a higher probability for the least favorable events. As this is a conservatory model from the financial point of view it is preferred by small companies whose activity depends on the lossess accumulated[6].

The Savage Criterion also known as **Minimax** or "the regrets method" uses the opportunity costs of incorrect decisions and recommends the retention of the sollution which minimizes the maximum regret. The concept of regret corresponds to the lack of gain resulting from a decision and it is measured starting from the difference between the gain obtained based on a certain decision and the gain which would have been obtained based on the best possible decision. This criterion is mainly used for the assessment of investment projects with a long life span.

The *Hurwitz criterion* identifies the decision which *maximizes the average result*. The average result corresponds to the weighted average of the minimum and maximum values of the decisions.This criterion retains the project which has the highest average value. It assures the choice of the variant with the highest profit potential but it is also characterized by considerable risk as maximum profit is always paralleled by maximum losses, a fact which is not taken into consideration by this criterion. The Hurwitz criterion allows the decision maker to analyse both the best and the worst result of each possible decision.

The Laplace criterion considers that the probabilities are equal and it ignores the other three criteria.

In conclusion, it is important to remember that taking risk into account does not mean eliminating it from an economic activity. This operation helps us, in the best case, to appreciate the possible consequences of risk on the dimensions of the efficiency of an activity.

Investments are risky because their results depend on an uncertain future.

No matter how much and varied information the economic entities might have, no matter how cautious or reticent they might be, they will never be able to avoid uncertainty or to eliminate risk. Regardless of the method of analysis used, risk cannot be eliminated completely – a certain level of uncertainity always characterizing any activity.

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[6] Simion D., *Investments*, Sitech Publishing House, Craiova, 2011, p.40